

CLAIMS

1. A multifunction-type vibration actuator comprising:
 - a thin plate-like diaphragm to an inner surface of which a voice coil;
 - a magnetic circuit part composed of a yoke, a magnet, and a pole piece; and
 - a leaf spring-like suspension for holding said magnetic circuit part is installed, said magnet circuit part is assembled inside a wall of a housing with said suspension, said voice coil is inserted into a magnetic gap of said magnetic circuit part such that said diaphragm fits tightly inside said wall of said housing, and said voice coil is electrically connected to an external terminal with lead wires pulled out to an outside of said wall, wherein said housing is integrally formed with a first house part with an elliptic wall and a second house part with a cylindrical wall of which a diameter corresponds to a width of said first house part at a center of a ellipse at both bottom walls of said first house part,
 - said elliptic diaphragm to which an inner surface of said annular voice coil is installed,
 - said circular magnetic circuit part provided with a magnetic gap into which said voice coil is inserted, and
 - said suspension is disk-shaped,
 - said elliptic diaphragm fits tightly inside a wall of said first house part, and said circular magnetic circuit part is assembled in a cylinder of said second house part with said suspension.
2. A multifunction vibration actuator according to Claim 1, wherein said elliptic diaphragm of which plate surface is provided with a plurality of V-grooves that radially extend at a same angle from a dome-shaped part surrounded by an annular voice coil at a center of a plate surface and that are long on semicircular plate surfaces located at both sides in a longitudinal direction and short on plate surfaces located at both sides in a lateral direction.
3. A multifunction vibration actuator according to Claim 1 or 2, wherein said elliptic diaphragm includes lead wires of said voice coil pulled out toward both sides while divided into positive and negative poles on a same semicircular plate surface from a dome-shaped part at a center of said plate surface.
4. A multifunction vibration actuator according to Claim 1, wherein said suspension comprises a central ring part for holding a circular magnetic circuit part and three arm parts circumferentially extending in a same direction with a same length from the proximal ends of arms located apart from each other at an angle of 120° on a ring part, a distal end of one of said arm parts extending outward from a second house part is

fitted and fixed in a dent located in middle of one of bottom wall surfaces and said distal ends of remaining two arm parts extending outward from said second house part are fitted and fixed in dents located at both sides of another bottom wall surface of said first house part.

5. A multifunction vibration actuator according to Claim 4, wherein said suspension having three arm parts of which distal ends are formed in different shapes, dents corresponding to a shape of each arm distal end are provided in a bottom wall surface of said first house part to install a suspension in a cylinder of said second house part by fitting said distal ends of said arms in dents.

6. A multifunction vibration actuator according to Claim 1 or 3, wherein an external terminal electrically connected to a voice coil is formed with a printed circuit board and said printed circuit board is installed to a bottom wall surface opposite to a diaphragm fitted surface at one of bottom walls of said first house part.

7. Portable communication equipment mounted with a multifunction vibration actuator according to one of Claims 1 through 6.